



State of Hawai‘i

Ocean Acidification Action Plan

2021 - 2031

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Acronyms

State of Hawai'i Departments and Divisions:

DLNR – Department of Land and Natural Resources
DAR – Division of Aquatic Resources
DOH CWB – Department of Health, Clean Water Branch
DOA – Department of Agriculture
Office of Planning
 CZM – Coastal Zone Management
 ORMP – Ocean Resource Management Plan

University of Hawai'i

SOEST – School of Ocean and Earth Science and Technology
UH – University of Hawai'i
Station ALOHA - A Long-term Oligotrophic Habitat Assessment
HOT – Hawai'i Ocean Time-series
C-MORE –
PacIOOS – Pacific Islands Observing System

Federal

NOAA – National Oceanic and Atmospheric Administration

International Organizations and Networks:

SPREP – Secretariat of the Pacific Regional Environmental Programme
IUCN – International Union for Conservation of Nature
GOA-ON – Global Ocean Acidification Observation Network
PI-TOA – (Pacific Islands & Territories Ocean Acidification) Network
UN – United Nations
UNFCCC -
SGD – Sustainable Development Goal
CBD –
NDC – National Determined Contributions

General terms:

MHI – Main Hawaiian Islands
OA – Ocean Acidification
LBSP – Land-based sources of pollution
QAPP – Quality Assurance Action Plan
K-12 – Kindergarten through 12th grade

Introduction to the State of Hawai'i Ocean Acidification Action Plan

The State of Hawai'i Ocean Acidification Action Plan was developed by the Department of Land and Natural Resources (DLNR) Division of Aquatic Resources (DAR) with support from the Hawai'i Department of Health, Hawai'i Department of Agriculture, the State of Hawai'i Climate Change and Mitigation Commission, the University of Hawai'i – School of Ocean and Earth Science and Technology, University of Hawai'i Sea Grant College Program, the International Alliance to Combat Ocean Acidification, and many other partners and stakeholders.

This Ocean Acidification Action Plan for the State of Hawai'i is based feedback from state departments, local experts, and partners on local Hawai'i issues, and from the International Alliance to Combat Ocean Acidification's "Action Plan Toolkit", which was developed through the West Coast Consortium, a partnership of the States of Washington, Oregon, California, and the province of British Columbia.

The State of Hawai'i activities, projects, and programs that have related to ocean acidification are jointly done by a number of departments and partners. This plan outlines existing activities that State Departments and partners are involved in, as well as forecasting future needs for activities projects, and programs from collaborative partnerships. For this reason, there was effort to put a stand alone plan together as well as integrate ocean acidification and climate considerations into other state plans.

DAR held several webinars to share the recent scientific understand of ocean acidification in Hawai'i and talk about the ways different states have built their Ocean Acidification Action Plans, and some pathways forward the State of Hawai'i could take. COVID-19 changed the way that we were able to host meetings and workshops, and so DAR hosted meetings with the contributors with a focus on each Goal related to their expertise to develop objectives and actions. DAR brought the 5 overall goals developed to the State Climate Change and Mitigation Commission for approval as part of the plan development process.

This Ocean Acidification Action Plan is the first of an iterative planning document that provides a strategic vision for developing and coordinating action around ocean acidification and the ocean-climate nexus. The State's actions will include ways to be understand, adapt, and mitigate, communicate, and network to combat the impacts of ocean acidification in Hawai'i. In future years, more comprehensive progress reports will include updates of actions implemented by this plan, and edits or changes to suggested actions can be made.

It will be important for State Legislature to create a formal working group of State and County that can guide the implementation and updates to this plan.

List of contributors

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Goal 2: Reduce carbon dioxide emissions and land-based sources of pollution

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Goal 3: Build adaptation and resilience of coastal communities to impacts of ocean acidification

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Office of Conservation and Coastal Lands:

Blue Carbon Ecosystem Potential for Hawai'i:

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Goal 4: Increase public understanding of ocean acidification (both general public and legislature)

Jason Mellinger, *Division of Aquatic Resources*

Examples from other states (examples: Alaska and California) and nations (examples: Aotearoa, NZ, and SPREP) on materials they developed

Goal 5: Build and continue international collaboration and support

Jessie Turner, *International Alliance to Combat Ocean Acidification*

The Ocean Foundation

Ocean Acidification Information Exchange

And examples of success from the GOA-ON and PI-TOA



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Director, Maui DP
Director, Hawai'i DP
Director, Kaua'i DP
The Adjutant General
Manager, CZM

Statement of Approval
Hawaii Climate Change Mitigation and Adaptation Commission
At its October 28th, 2020 meeting
In support of Item 3.II

Hawaii's oceans are being impacted by climate change. The damage from greenhouse gas emissions have led to rising global temperatures, subsequent ice melt and changing water chemistry. These changes impact the oceans, impeding their ability to sequester carbon and to provide a resilient coral reef ecosystem in Hawaii's nearshore waters.

As the state works to mitigate and adapt to the impacts of climate change, incorporation of ocean actions into our climate actions is imperative for our island state surrounded by ocean. There is a synergy between actions to combat, adapt, and build resilience against ocean acidification, and our general actions to address climate change. To encourage the coordination of these actions, the Commission approves the general work being undertaken under Hawaii's membership in the International Alliance to Combat Ocean Acidification in 2018. The drafting and completion of the State of Hawai'i Ocean Acidification Action will be submitted as a voluntary commitment for the U.N's Sustainable Development Goals, in particular SDG 14, with a focus on ocean acidification under SDG 14.3.

To further this work:

1. The Commission approves of the five goals of the State of Hawai'i's Ocean Acidification Action Plan, as listed below:

1. Increase scientific understanding of ocean acidification in the region (SDG 14.3);
2. Reduce carbon dioxide emissions and land-based sources of pollution (SDG 13);
3. Build adaptation and resilience of coastal communities to impacts of ocean acidification (SDG 14);
4. Increase public understanding of ocean acidification (both general public and legislature) (SDG 14.3); and
5. Build and continue international collaboration and support.

2. The Commission encourages any and all coordination and collaboration within State of Hawai'i with counties, other states, and federal, private, and academic partners to enhance action on ocean and climate issues.

Overview of Goals and Objectives

Goal 1: Increase scientific understanding of ocean acidification in the region

- **Objective 1:** Inventory of monitoring efforts, impacted ecosystem types, resources, and people
- **Objective 2:** Conduct research to further our understanding of ocean acidification in the region
- **Objective 3:** Conduct vulnerability and risk assessments and gap analysis studies

Goal 2: Reduce carbon dioxide emissions and land-based sources of pollution (LBSP)

- **Objective 1:** Support mitigation on national and global levels
- **Objective 2:** Support mitigation on local levels
- **Objective 3:** Support local level reduction of land-based sources of pollution

Goal 3: Build adaptation and resilience of coastal communities to impacts of ocean acidification

- **Objective 1:** Remediate or ameliorate impacts of ocean acidification
- **Objective 2:** Increase adaptation capacity and species resilience in local communities
- **Objective 3:** Adaptive management includes ocean acidification

Goal 4: Increase public understanding of ocean acidification (both general public and legislature)

- **Objective 1:** Increase awareness about ocean-climate issues and ocean acidification in the government and legislature
- **Objective 2:** Engage local stakeholders
- **Objective 3:** Educate the general public about acidification

Goal 5: Build and continue international collaboration and support

- **Objective 1:** International collaboration and support
- **Objective 2:** National collaboration that supports international
- **Objective 3:** Local action using examples from international collaboration

Executive Summary

Global atmospheric carbon dioxide (CO₂) levels are rising from human activities, primarily fossil fuel burning. Increases in carbon in our environment are not only changing our Earth's climate, but are also changing our ocean's chemistry. Our ocean absorbs about a quarter of the CO₂ released by human activity, and this excess CO₂ is shifting the ocean's chemical balance, causing ocean acidification (OA). Data from Station ALOHA, located 60 miles north of O'ahu, are a global standard for carbon measurements not only in our air but in our waters (Figure 1).

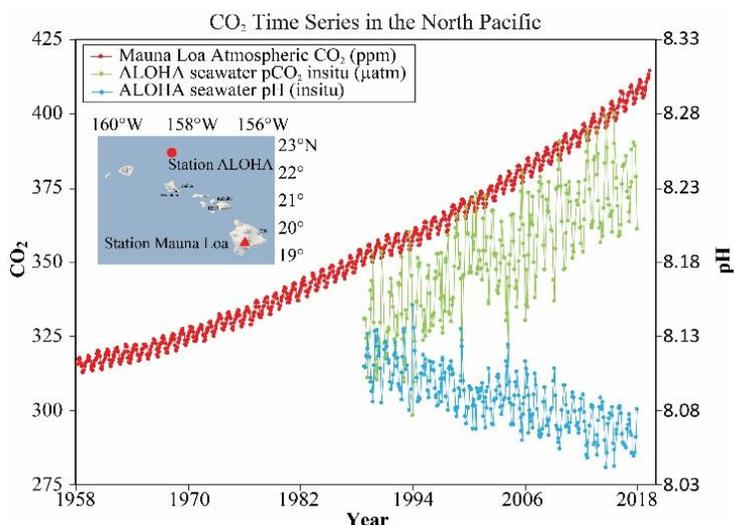


Figure 1. Rate of pH and pCO₂ change at Station ALOHA

Hawai'i is impacted by not only global ocean acidification, but also the impact of by coastal acidification resulting from localized land-based pollution that can exacerbate the coastal water chemistry changes.

In 2018, the State of Hawai'i, Governor Ige, and Chair of the Department of Land Natural Resources Suzanne Case, agreed that the State of Hawai'i become a member of the International Alliance to Combat Ocean Acidification, and in doing so committed to creating this Action Plan. Previous efforts included a '*Honolulu Declaration on Ocean Acidification and Reef Management*' completed in 2008 by the Nature Conservancy and the International Union for Conservation of Nature's Climate Change and Coral Reefs Working Group.

The State of Hawai'i Ocean Acidification Action Plan outlines actions that the State of Hawai'i will take to understand, mitigate, and adapt to ocean acidification impacts from 2021 - 2031. Through this Action Plan, Hawai'i joins other state and global partners to continue building solutions to adapt and prepare for ocean acidification impacts now and in the future. Action requires state leadership and resources to implement projects that will improve understanding of ocean acidification and steps to adaptation and mitigation activities. Partnerships, and interjurisdictional work, and collaboration with communities, will be instrumental in implementing these actions and work to improve our collective future

Resources:

[Station ALOHA](#) and [Hawai'i Ocean Time-series \(HOT\)](#)

[Woods Hole Oceanographic Institution Hawai'i Ocean Time-series Sites \(WHOTS\)](#)

[International Alliance to Combat Ocean Acidification](#)

[Honolulu Declaration on Ocean Acidification and Reef Management](#)

Goal 1: Increase scientific understanding of ocean acidification in the region

Objective 1: Inventory of monitoring efforts, impacted ecosystem types, resources, and people

- **Action 1:** Assess current monitoring efforts, locations, and agencies involved
- **Action 2:** Redistribute existing moorings across the Main Hawaiian Islands
- **Action 3:** Align biological monitoring and conservation efforts, such as marine management areas, with water quality ocean acidification monitoring or other climate parameters
- **Action 4:** Formalize a Hawai'i Ocean Acidification Monitoring Network with partners

Objective 2: Conduct research to further our understanding of ocean acidification in the region

- **Action 1:** Support laboratory and in-situ research to identify impacts to native species from ocean acidification
- **Action 2:** Develop predictive and forecast models to inform responsive decision-making and management for impacts of open ocean acidification
- **Action 3:** Use information about land-based sources of pollution to predict areas potentially impacted by coastal acidification
- **Action 4:** Investigate unique island-based characteristics such as: mass island impact, differences in windward and leeward coasts and currents, and stream and groundwater impacts on volcanic islands

Objective 3: Conduct vulnerability and risk assessments, and gap analysis studies

- **Action 1:** Commission a Hawai'i based vulnerability assessments with an emphasis on social, cultural, and economic vulnerabilities, utilizing data from predictive and forecast models
- **Action 2:** Complete a risk assessment and gaps analysis based on resources, their estimated value, and current available capacity
- **Action 3:** Reidentify prioritizes based on these vulnerabilities, risk assessment, and gaps analysis

Goal 2: Reduce carbon dioxide emissions and land-based sources of pollution (LBSP)

Objective 1: Support mitigation of carbon dioxide on national and global levels

- **Action 1:** Support national policies that reduce anthropogenic carbon emissions and greenhouse gas emissions, and switches to cleaner energy
- **Action 2:** Integrate ocean into climate commitments, policies, and multigovernmental framework such as Natural Working Lands, and 30x30 Commitments
- **Action 3:** Engage in multi-state gatherings to share and engage, and elevate multi-state work to showcase collective action

Objective 2: Support mitigation of carbon dioxide locally

- **Action 1:** Support State of Hawai'i Climate Change Mitigation and Adaptation Commission activities and the development of county Climate Action Plans, such as the City and County of Honolulu's Climate Action Plan
- **Action 2:** Participate in and contribute to ocean and marine solutions to Climate Ready Hawai'i Initiative, with a focus on nature-based solutions
- **Action 3:** Support work on determining the potential of blue carbon ecosystems in Hawai'i
- **Action 4:** Request assessments of comparisons of carbon drawdown potential of Hawai'i's native species of wetland and marine plant species in comparison to invasive species (such as mangroves).

Objective 3: Support local level reduction of land-based sources of pollution

- **Action 1:** Develop a Quality Assurance Action Plan for inclusion of ocean acidification parameters in water quality data based on standards for monitoring developed by the Hawai'i Ocean Acidification Monitoring Network, and the recommendations by the UN SDG 14.3.1
- **Action 2:** Investigate linkages between land-based sources of pollution on localized coastal ocean acidification
- **Action 3:** Promote collaboration with state departments, (i.e. Office of Planning and Sustainable Development – Coastal Zone Management, Department of Health) in charge of nutrient loading, storm water, and wastewater

Goal 3: Build adaptation and resilience of coastal communities to impacts of ocean acidification

Objective 1: Remediate or ameliorate impacts of ocean acidification

- **Action 1:** Determine the extent to which native aquatic vegetation (including coastal and marsh plants, algae, and sea grasses) can absorb or sequester carbon
- **Action 2:** Identify refugia areas across the state for ocean acidification, and prioritize protection of species which are vulnerable to ocean acidification, like coral and shellfish, in these refugia areas
- **Action 3:** Improve local resilience by managing resources and human activities, that reduce the impacts of climate change and land-based sources of pollution causing ocean and coastal acidification

Objective 2: Increase adaptation capacity and species resilience in local communities

- **Action 1:** Continue to support watershed and coastal restoration projects and partnerships that especially those that engage local communities
- **Action 2:** Support fishpond restoration that builds biocultural and ecological resilience
- **Action 3:** Support and fund an increase statewide hatchery and nursery capacity for local food production

Objective 3: Include ocean acidification in adaptive management

- **Action 1:** Incorporate ocean acidification into existing short- and long-term state resource management plans and adaptive management actions
- **Action 2:** Align fisheries assessments with climate related changing ocean conditions
- **Action 3:** Fund alternative sustainable fishing opportunities and invest in growing and restoration of algae and bivalves along with nitrogen and carbon sequestering habitat improvements

Goal 4: Increase public understanding of ocean acidification (both the general public and the legislature)

Objective 1: Increase the prevalence of ocean-climate issues and ocean acidification in government and legislature discussion and policy

- **Action 1:** Look at previous inventories of climate bills and climate champions for the state of Hawai'i as well as previous ocean acidification legislation passed by other states
- **Action 2:** Create legislative material: technical briefings, talking points, 2-pagers, slide decks, talk story sessions, and agenda items at public meetings
- **Action 3:** Collaboratively assist with bill development about ocean climate issues and ocean acidification for adoption by legislators

Objective 2: Provide opportunities for local stakeholders to identify and understand the scope of ocean acidification vulnerabilities in their local ecosystems

- **Action 1:** Characterize the vulnerability of marine life, habitat, and ecosystems of interest to stakeholders, and make communication materials that describe their potential impact from OA
- **Action 2:** Through the process of vulnerability analysis, provide up to date information about hotspots of bioerosion and ocean acidification vulnerabilities
- **Action 3:** Produce an education campaign using the feedback from the vulnerability analysis, and local species and habitat research

Objective 3: Educate the general public about acidification

- **Action 1:** Update University of Hawai'i – Center for Microbial Oceanography Science Kits on ocean acidification for K-12 students
- **Action 2:** Develop accessible public resources such as: websites, newsletters, infographics, video, social media calendar and content
- **Action 3:** Produce an education campaign using the feedback from the vulnerability analysis



Goal 5: Build and continue international collaboration and support

Objective 1: International collaboration and support

- **Action 1:** Conduct high level engagement at United Nations, the Convention on Biological Diversity, The United Nations Framework Convention on Climate Change, to work on Sustainable Development Goals related to ocean-climate solutions
- **Action 2:** Scientific engagement across the Pacific region, through partners such as the Pacific Islands and Territories Ocean Acidification network, the Secretariat of the Pacific Regional Environment Programme, and the Pacific Islands Observing System
- **Action 3:** Development and strategy work with international partners - continued engagement with International Alliance to Combat Ocean Acidification and the Ocean Foundation

Objective 2: National collaboration supporting framework

- **Action 1:** Improve working relationship with national partners through sub-national coalitions such as the US Climate Alliance and work with states members of the International Alliance to Combat Ocean Acidification
- **Action 2:** Deeper engagement with the National Oceanic and Atmospheric Administration Ocean Acidification Program to look at cross-cutting coral reef ocean acidification strategies.
- **Action 3:** Continued work to incorporate ocean and acidification into climate action related to the federal Executive Orders on climate change and 30x30.

Objective 3: State and local action supporting framework

- **Action 1:** Using sample legislation from other states and nations, establish Task Force or formal Working Group for capacity needs for implementation through legislation
- **Action 2:** Continue work with the State of Hawai'i Climate Change Mitigation and Adaptation Commission to incorporate forecasted impacts of ocean acidification into statewide planning, similar to existing sea level rise planning
- **Action 3:** Continued work with Department of Land and Natural Resources and Department of Health develop water quality standards established by ocean acidification parameters, and coordination through Office of Planning and Sustainable Development's Ocean Resources Management Plan for land-based sources of pollution.
- **Action 4:** Based on standards for water quality established for ocean acidification parameters, investigate the potential for regulations

State of Hawai'i. 2021. State of Hawai'i Ocean Acidification Action Plan 2021 – 2031.

This Ocean Acidification Action Plan was prepared with the support of partners from University of Hawai'i, National Oceanic and Atmospheric Administration, and other departments within the State of Hawai'i. Writing was drafted by Division of Aquatic Resources, Department of Land and Natural Resources, from support from the E. Gordon Grau Fellowship Program from University of Hawai'i Sea Grant College Program. The contents of this document may or may not reflect the views of the individual organizations and agencies included on this document. Any photos without photo credits were accessed through creative commons sources.

